PATENT ABSTRACTS OF JAPAN

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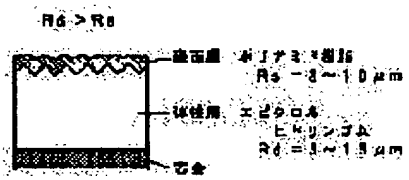
(54) ELECTROSTATICALLY CHARGING ROLLER

(57)Abstract:
PURPOSE: To improve durability by improving the surface of middle-resistance polar synthetic rubber to a state of good non-adhesiveness of a photosensitive body and toners.
CONSTITUTION: The center line average height Rd of the elastic layer of the electrostatic charging roller having at least two layers; the elastic layer and a surface layer covering the surface of the elastic layer is set larger than the center line average height Rs of the surface layer. For example, the surface of the epichlorhydrine rubber elastic layer having 5 to 15μm center line average height Rd is coated with a polyamide resin surface layer (Rs: 3 to 10μm) having an average film thickness of ≤2 times Rd in such a manner that the Rd of the epichlorhydrine rubber elastic layer is made small.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] The front face of an elastic layer and said elastic layer is set at least on the electrification roller which has two-layer [of a wrap surface layer], and it is the surface average of roughness height Rd of said elastic layer. The surface average of roughness height Rs of said surface layer Electrification roller characterized by the large thing.
[Claim 2] In the electrification roller which has two-layer [of a wrap surface layer], electric resistance consists of polar synthetic rubber of 107 - 1010 ohm-cm in the front face of an elastic layer and said elastic layer, and said elastic layer at least is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers.
[Claim 3] In the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least, said elastic layer is more than rubber degree-of-hardness 40 (JISA), and it is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers.
[Claim 4] Setting the front face of an elastic layer and said elastic layer at least on the electrification roller which has two-layer [of a wrap surface layer], said elastic layer is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers and being the epichlorohydrin rubber or polyurethane rubber whose thickness is 1-5mm.
[Claim 5] Setting the front face of an elastic layer and said elastic layer at least on the electrification roller which has two-layer [of a wrap surface layer], the average thickness of said surface layer is the surface average of roughness height Rd of said elastic layer. Electrification roller characterized by being 2 double less or equal.
[Claim 6] The front face of an elastic layer and said elastic layer is set at least on the electrification roller which has two-layer [of a wrap surface layer], and it is the surface average of roughness height Rs of said surface layer. Electrification roller characterized by being 3-10 micrometers.
[Claim 7] It is the electrification roller characterized by consisting of a non-adhesive property resin coat which was thick to the surface crevice of said elastic layer in the electrification roller which has two-layer [of a wrap surface layer] as for said surface layer, and was thinly applied in the front face of an elastic layer and said elastic layer at heights at least.
[Claim 8] It is the electrification roller characterized by consisting of synthetic resin in which said surface layer has solubility to alcohol in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least.
[Claim 9] It is the electrification roller characterized by said surface layer containing at least one of the components of various inorganic bulking agents, various conductive particles, and said elastic layer in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates the front face of an elastic layer and this elastic layer to the electrification roller which has two-layer [of a wrap surface layer] at least more about the electrification roller used for contact roller electrification equipment at a detail.
[0002]
[Description of the Prior Art] Conventionally, in the image formation equipment of an electrophotography method, the corona discharge machine was widely used as an electrification means for a photo conductor front face being charged completely uniformly. Although it is effective as a means by which a photo conductor is charged in a certain fixed potential at homogeneity if it is in this corona discharge machine, on the contrary, if it is in the electrification processing by corona discharge, a high voltage power supply is needed, and ozone occurs with discharge. When ozone occurred in large quantities, it not only has a bad influence on an environment, but there was a trouble that an electrification member and a photo conductor deteriorated by ozone.
[0003] To the above-mentioned corona discharge machine, as shown in drawing 7 , the electrification roller 701 is contacted to the photo conductor drum 702, and carries out follower rotation, and the electrification roller which an electrical potential difference is impressed [roller] to the rodding 703 of the electrification roller 701 from a power source 704, and electrifies photo conductor drum 702 front face is put in practical use. The electrification roller 701 as this electrification means can attain low-battery-ization of a power source 704, and has the advantage that there are few yields of the ozone resulting from electrification processing. Moreover, there is no electrostatic adsorption of the dust accompanying use of a corona electrode wire, and it also has the advantage of not needing a high voltage power supply.
[0004] However, are easy to come out of electrification nonuniformity, and an electrification roller has the fault of changing electrification potential sharply by environmental change, and the present condition is that it is considerably inferior about the homogeneity of this electrification as compared with the electrification processing with a corona discharge machine.
[0005] For this reason, in order to improve the homogeneity of electrification, by the "contact electrification approach" of JP,63-149668,A, it is indicating that the homogeneity of electrification can improve considerably by making alternating voltage with the starting potential (VTH) at the time of direct-current-voltage impression twice [more than] the electrical potential difference between peaks of electrification superimpose.
[0006]
[Problem(s) to be Solved by the Invention] However, if it is in the "contact electrification approach" of above-mentioned JP,63-149668,A In order to make alternating voltage with the starting potential (VTH) at the time of direct-current-voltage impression twice [more than] the electrical potential difference between peaks of electrification superimpose, Apart from a DC power supply, an AC power is needed, and it invites the cost rise of equipment itself, and power-source cost not only goes up, but further, useless AC current which does not contribute to electrification of a photo conductor will be consumed so much, and a lot of ozone occurs in connection with it. Consequently, an electrification member, Degradation of a photo conductor was invited and there was un-arranging [of having developed even into a pollution problem further].
[0007] For this reason, in order to enable it for this invention person to perform electrical-potential-difference impression on an electrification roller only using a DC power supply, without using an AC power, the electrification roller using the polar synthetic rubber (epichlorohydrin rubber) of inside resistance in an elastic layer is proposed. As a result of considering the cause by which electrification nonuniformity generates [this invention person] this only in DC electrical-potential-difference impression, the elastic layer originates in it being the dispersion layer of synthetic rubber

and carbon, Namely, it is what is depended on the electric heterogeneity of the conductive elastic layer depended badly [distribution of carbon/synthetic rubber]. Electric heterogeneity is abolished and it enables it to cancel the electrification nonuniformity which is generated only in DC electrical-potential-difference impression by discovering a certain thing and transposing the elastic layer by the carbon/synthetic rubber of an electrification roller to the polar synthetic rubber (epichlorohydrin rubber) of inside resistance.

[0008] Moreover, only in DC electrical-potential-difference impression, although the withstand voltage of a roller layer poses a problem, as compared with the case of the conductive elastic layer of the conventional carbon / synthetic-rubber system, withstand voltage nature is remarkably raised by using the epichlorohydrin rubber of inside resistance in an elastic layer. Furthermore, epichlorohydrin rubber has a rubber degree of hardness comparatively as high as 40 (JISA), and since there is also little elastic strain deformation, a mechanical strength is also good [rubber].

[0009] Although the addition of carbon was able to adjust apparent electric resistance in the conductive elastic layer of the conventional carbon / synthetic-rubber dispersed system, it was very difficult to reconcile moderate conductivity (108 omega-cm) and withstand voltage nature. And since the part of carbon differed in electric resistance greatly from the part of synthetic rubber when it sees micro, it worsened the homogeneity of electrification, and withstand voltage nature. However, when rubber itself used the polar synthetic rubber of inside resistance (107 - 108 omega-cm) for the electrification roller elastic layer, without being based on content of conductive particles, such as carbon, all the troubles that come from the electrical characteristics of the above-mentioned electrification roller were solved.

[0010] The above-mentioned electric and mechanical property are excellent. The electrification roller of the polar synthetic rubber of inside resistance in which homogeneity electrification is possible actually only by DC electrical-potential-difference impression however, as roller electrification equipment of a copying machine Since an electrification roller and a photo conductor are in a pressure-welding condition during a pause of a copying machine when it is used, The trouble that a horizontal stripe-like abnormality image is generated in the image of the 1st sheet after a prolonged pause, and the trouble that a toner would adhere to a roller front face and the electrification engine performance of an electrification roller would fall if an electrification roller is used for a long period of time occurred.

[0011] Moreover, as a conventional technique relevant to this invention, there are JP,58-194061,A "roller electrification equipment" and JP,2-222985,A "electrophotography equipment."

[0012] The equipment of JP,58-194061,A removes the toner dirt of an electrification roller front face by approaching the electrification roller front face which consists of a conductive elastic body, and preparing a cleaning component, and carrying out the coat of the non-adhesive property coat to the front face of a conductive elastic body.

[0013] Moreover, the equipment of JP,2-222985,A is 2<=6.0 micrometers (however, 1<=5.0 micrometers of 0.05 micrometer<=RZ, 2<=5.0 micrometers of 0.05 micrometer<=RZ) of 0.1 micrometer<=RZ 1+RZ about the relation of ten-point surface average-of-roughness-height RZ1 of a photo conductor, and ten-point surface average-of-roughness-height RZ2 of the member for electrification.

The moderate split-face section used as a photo conductor and the origin of discharge to each of both of the member for electrification is formed, the fall of breakdown voltage is aimed at, the electrification capacity of the member for electrification is raised, and it enables it to perform uniform electrification excellent in the potential property by carrying out.

[0014] This invention is made in view of the above, and it aims at offering the electrification roller which raised endurance by improving an inside resistance polarity synthetic-rubber front face in a photo conductor and a toner, and the good condition of a non-adhesive property.

[0015]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer A large electrification roller is offered.

[0016] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer], electric resistance consists of polar synthetic rubber of 107 - 1010 ohm-cm in the front face of an elastic layer and an elastic layer at least, and an elastic layer is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers is offered.

[0017] Moreover, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least in order that this invention may attain the above-mentioned purpose, an elastic layer is more than rubber degree-of-hardness 40 (JISA), and it is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers is offered.

[0018] Moreover, in order that this invention may attain the above-mentioned purpose, it sets on the electrification roller

which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and an elastic layer is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers and is the epichlorohydrin rubber or polyurethane rubber whose thickness is 1-5mm is offered.
[0019] Moreover, in order that this invention may attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and the average thickness of a surface layer is the surface average of roughness height Rd of an elastic layer. The electrification roller which is 2 double less or equal is offered.
[0020] Moreover, in order to attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and this invention is the surface average of roughness height Rs of a surface layer. Electrification roller which is 3-10 micrometers.
[0021] Moreover, in order that this invention may attain the above-mentioned purpose, the electrification roller which consists of a non-adhesive property resin coat which the surface layer was thick to the surface crevice of an elastic layer in the electrification roller which has two-layer [of a wrap surface layer], and was thinly applied in the front face of an elastic layer and an elastic layer at heights at least is offered.
[0022] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, a surface layer offers the electrification roller which consists of synthetic resin which has solubility to alcohol.
[0023] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, a surface layer offers the electrification roller containing at least one of the components of various inorganic bulking agents, various conductive particles, and said elastic layer.
[0024]
[Function] The electrification roller of this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer A non-adhesive property is improved maintaining an electrification property by enlarging.
[0025] Moreover, in the electrification roller of this invention, electric resistance constitutes an elastic layer from polar synthetic rubber of 107 - 1010 ohm-cm, and it is the surface average of roughness height Rd. A non-adhesive property is improved maintaining an electrification property by being referred to as 5-15 micrometers.
[0026] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd about an elastic layer above rubber degree-of-hardness 40 (JISA). A non-adhesive property is improved maintaining an electrification property by being referred to as 5-15 micrometers.
[0027] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd about an elastic layer. A non-adhesive property is improved maintaining an electrification property by considering as the epichlorohydrin rubber or polyurethane rubber the thickness of whose is 1-5mm by 5-15 micrometers.
[0028] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd of an elastic layer about the average thickness of a surface layer. A non-adhesive property is improved maintaining an electrification property by considering as 2 double less or equal.
[0029] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rs of a surface layer. A non-adhesive property is improved maintaining an electrification property by being referred to as 3-10 micrometers.
[0030] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by using a surface layer as the non-adhesive property resin coat thick [to the surface crevice of an elastic layer] and applied thinly at heights.
[0031] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by constituting a surface layer from synthetic resin which has solubility to alcohol.
[0032] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by considering a surface layer as the configuration containing at least one of the components of various inorganic bulking agents, various conductive particles, and an elastic layer.
[0033]
[Example] The power source to which drawing 1 shows the electrification roller experimental device for evaluating the electrification property of an electrification roller, the electrification roller with which 101 is set as the object of evaluation, and 102 impress rodding of the electrification roller 101 to the rodding 102 of the electrification roller 101 in drawing, and 103 impresses the DC electrical potential difference Va, and 104 are electrometers for a photo conductor drum and 105 to measure an electric discharge lamp, and at least for electrification of the front face of the photo

conductor drum 104 measure Vs, as for 106.
[0034] In the above configuration, how to evaluate the electrification property of an electrification roller using the above-mentioned roller electrification experimental device is explained. First, the DC electrical potential difference Va is impressed to the electrification roller 101 which contacts the photo conductor drum 104 which rotates with linear velocity v, and carries out follower rotation, at least electrification is charged in Vs in photo conductor drum 104 front face discharged with the electric discharge lamp 105, and at least electrification of the photo conductor drum 104 measures Vs with an electrometer 106. From the electrification property chart which it is as a result of [of this electrometer 106] measurement, as shown in drawing 2 , at least the standup of Vs and electrification can evaluate the homogeneity of Vs and Vs.
[0035] Drawing 3 shows the image formation equipment of a roller electrification method, and in drawing, a drum cleaner and 305 show an electric discharge lamp, 306 shows an imprint belt, and the laser beam a photo conductor drum and whose 302 101 is exposure information as for an electrification roller and 301, and 303 use a developer and 304 in order to check the trouble on real use of an electrification roller. As shown in drawing 4 , an output image is checked, the non-adhesive property over the photo conductor of an electrification roller is evaluated from ** horizontal stripe image (roller trace on a photo conductor) 401, and, specifically, the cleaning nature on the front face of a roller is evaluated from the dirt 402 of the image after ** running test.
[0036] Drawing 5 shows the configuration of the electrification roller by this invention, the electrification roller of the example of a comparison, and the conventional electrification roller, and Table 1 shows each property of the electrification roller shown in drawing 5 .
[0037]
[Table 1]

	帯電特性			表面性	
	立上り	帯電性	均一性	非接着性	クリーニング性
従来例	○	△	×	○	○
比較例	○	○	○	×	×
本発明	○	○	○	○	○

[0038] Drawing 5 (a) shows the conventional electrification roller, and has prepared the nylon (polyamide resin) surface layer (100-micrometer thickness, 103 omega-cm) on the carbon distribution silicone rubber elastic layer (3mm thickness, electric resistance 104 omega-cm), and as shown in 201 of Table 1 and drawing 2 , a problem is in the homogeneity of electrification. However, AC electrical potential difference is superimposed on DC electrical potential difference, and homogeneity electrification will be acquired if electrical-potential-difference impression is carried out.
[0039] Although the homogeneity of electrification of at least electrification is improved as the electrification roller as an example of a comparison is shown, and it consists of a monolayer of epichlorohydrin rubber (3mm thickness, electric resistance 108 omega-cm) and is shown in 203 of Table 1 and drawing 2 , front-face nature of drawing 5 (b) is bad, and is not practical.
[0040] So that drawing 5 (c) may show the electrification roller of this invention, and may split-face-ize a resistance (107 - 108 omega-cm)-into more than rubber degree-of-hardness 40 (JISA) polarity synthetic-rubber (epichlorohydrin rubber) elastic layer and a part for the crevice may be embedded As the thin (1-5-micrometer thickness) exaggerated code layer (surface layer) of non-adhesive property resin (nylon: 1010 ohm-cm) is prepared and it is shown in 202 of Table 1 and drawing 2 Front-face nature was able to be made to improve sharply, with the electrification property of the electrification roller (drawing 5 (b)) as an example of a comparison maintained. Hereafter, an example explains to a detail.
[0041] [Example 1] First, epichlorohydrin rubber elastic layer was cast so that a roller outer diameter might be set to about 16 phi at rodding of 8phi. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA). While making this elastic roller into 3mm of elastic thickness by mechanical polishing, it is the ten-point surface average of roughness height Rd. Every three each were ground so that it might be set to 3 micrometers, 5 micrometers, 10 micrometers, 15 micrometers, 20 micrometers, and 30 micrometers.
[0042] Next, on this elastic layer, as a surface layer, with the spray method, the paint film of polyamide resin was applied so that that average thickness might be set to 5 micrometers, 10 micrometers, and 30 micrometers, and the

electrification roller of an example 1 was created.
[0043] Then, the ten-point surface average of roughness height Rs of the surface layer (namely, roller front face) of the created electrification roller It measured. The ten-point surface average of roughness height Rs of this surface layer Measurement was performed using the surface type-like measuring instrument (SE-30H, Kosaka Laboratory make) based on JIS surface roughness (BO601).
[0044] It is the surface average of roughness height Rd as mentioned above. The evaluation result of the surface average of roughness height Rs of a total of 18 electrification rollers which prepared and created the surface layer which consists of polyamide resin of 5-30 micrometers of average thickness on epichlorohydrin rubber elastic layer (3mm in thickness), an electrification property, and front-face nature is shown in Table 2.
[0045]
[Table 2]

Rd (μm)	表面層 平均厚さ	Rs (μm)	帯電特性		表面性	
			Vs	均一性	非接着性	クリーニング性
3		6		×	×	×
5		5		△	△	△
10	5 μm	8	800V	○	△	△
15		12		○	△	△
20		17		×	△	△
30		25		×	△	△
3		4		○	△	△
5		4		○	○	○
10	10 μm	6	750V	○	○	○
15		10		○	○	○
20		14		×	○	△
30		16		×	○	△
3		3		○	○	○
5		3		○	○	○
10	30 μm	5	660V	○	○	○
15		9		△	○	○
20		12		×	○	△
30		14		×	○	△

[0046] It is the surface average of roughness height Rs on the front face of a roller (surface layer) so that clearly from the above-mentioned table 2. The surface average of roughness height Rd of an elastic layer It depends also on the thickness and the method of application of a surface layer the outside for which it depends. It is desirable that it can apply so that the surface roughness of an elastic layer may moreover be corrected by as thin the surface layer as possible. Vs falls, so that an electrification property has a thick surface layer, and the homogeneity of electrification is Rd. It worsens, so that it is large. However, Rd 5 Carrying out to below mum is contrary to improving in a photo conductor and a toner, and the good condition of a non-adhesive property, using the sand PURASUTO method etc. for surface polish, and maintaining the electrification property which it becomes [a manufacturing cost] high and is not not only desirable, but is the purpose of this invention. Moreover, front-face nature is so good that a surface layer is thick, and has the relation which disagrees with an electrification property.
[0047] Therefore, the following conclusions can be obtained from the above experimental data. As shown in drawing 6 , it is the surface average of roughness height Rd. On the epichlorohydrin rubber elastic layer which is 5-15 micrometers, average thickness is Rd. About the polyamide resin surface layer (Rs:3-10micrometer) of 2 double less or equal, it is Rd of epichlorohydrin rubber elastic layer. By coating so that it may be made small, the electrification roller excellent in an electrification property and front-face nature (endurance) can be obtained.
[0048] Furthermore, the surface average of roughness height Rd By being referred to as 5-15 micrometers, the cost for surface polish is reducible.
[0049] [Example 2] First, a polyurethane rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness, and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x109. Omega-cm and a rubber degree of hardness were 40

(JISA).
[0050] Low resistance-ization of polyurethane rubber can be attained by carrying out content molding of the alkali-metal salt to polyurethane rubber. And the reduction in resistance is [in / the whole elastic layer / there is also no variation in resistance like / in conductive particle distribution of carbon etc. / in this case, and] possible to homogeneity (refer to ****** No. 189876 [63 to] official report). Especially, a fault halogen oxygen acid salt is the optimal also in an alkali-metal salt. Moreover, when 0.05wt% lithium perchlorate is added to polyurethane rubber, resistance falls a single figure and it is 3x108. It becomes omega-cm.
[0051] Next, the copolyamide (CM8000) 6 weight section was dissolved in the methanol 100 weight section, on the polyurethane rubber elastic layer, it applied by the dipping method and the surface layer was formed. The surface layer average thickness after desiccation is 7 micrometers, and is the surface average of roughness height Rs. It was 6 micrometers.
[0052] the place measured with the roller electrification experimental device which showed the electrification property of this electrification roller to drawing 1 -- Va=-1.5kV -- receiving -- the OPC photo conductor drum 104 (28 micrometers of thickness) -- Vs=600-620V -- it has been mostly charged in homogeneity. As compared with the case where an elastic layer is epichlorohydrin rubber, it is thought that the thing with Vs low about 150v is because electric resistance is high a single figure on these conditions. However, if it is used by Va=-1.6kV, there will be no practical problem.
[0053] Then, as a result of performing a running test using the image formation equipment shown in drawing 3 , also after 10 K sheet use, there was also no generating of abnormality images, such as a horizontal stripe, and Vs fall by the dirt of an electrification roller front face was also satisfactory on the image.
[0054] In addition, as synthetic resin which has solubility to alcohol by surface layer configuration resin, polyvinyl butyral resin and poly vinyl alcohol resin were effective in addition to Nylon.
[0055] [Example 3] First, epichlorohydrin rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness, and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA).
[0056] Next, the solvent meltable mold fluororesin solution (solid content: 10.8wt%) was diluted with the toluol, and coating was carried out with the spray method on the above-mentioned elastic layer. The surface layer average thickness after desiccation is 6 micrometers, and is the roller surface average of roughness height Rs. It was 7.5 micrometers.
[0057] When the electrification property of this electrification roller was measured with the roller electrification experimental device of drawing 1 , it was Vs=770V and homogeneity was also good. Moreover, as a result of performing a running test using the image formation equipment shown in drawing 3 , there was no generating of an abnormality image also after [of 20] K sheets. Especially concerning the front-face nature of an electrification roller, the fluororesin improved the mold-release characteristic over a toner, and cleaning nature improved.
[0058] In addition, as non-adhesive property resin of a surface layer configuration, silicon resin, urethane resin, acrylic resin, polyethylene resin, polyamide resin, etc. were effective in addition to the fluororesin.
[0059] [Example 4] First, epichlorohydrin rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness, and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA).
[0060] Next, the epichlorohydrin rubber solution (solid content: 2.5wt%) 100 weight section, the solvent meltable mold fluororesin solution (solid content: 10.8wt%) 80 weight section, and the silica 0.6 weight section were dissolved in the toluol, and coating was carried out with the spray method on the elastic layer. The surface layer average thickness after desiccation is 8 micrometers, and is the surface average of roughness height Rs. It was 7 micrometers.
[0061] When the electrification property of this electrification roller was measured with the roller electrification experimental device of drawing 1 , it was as high as Vs=800V and homogeneity was good. This is based on the effectiveness of having made the surface layer containing epichlorohydrin rubber. On the other hand, the non-adhesive property over OPC (photo conductor drum) has been remarkably improved by addition of a silica, and generating of a horizontal stripe of the front-face nature of an electrification roller was completely lost in the image of the 1st sheet after a prolonged pause.
[0062] In addition, as an inorganic bulking agent, there are a zinc oxide, titanium oxide, tin oxide, etc. in addition to a silica.
[0063] [Example 5] When creating the electrification roller of an example 3, and 3wt% of carbon addition was performed in silicone resin use and the electrification roller was created to it as non-adhesive property resin of a surface

layer, as compared with what does not perform carbon addition, the electrification property (about electrification homogeneity) has been improved further.

[0064]

[Effect of the Invention] It explained above. The electrification roller of this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer Since it is large, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0065] Moreover, electric resistance constitutes an elastic layer from polar synthetic rubber of 107 - 1010 ohm-cm, and the electrification roller of this invention is the surface average of roughness height Rd. Since it is referred to as 5-15 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0066] Moreover, the electrification roller of this invention is more than rubber degree-of-hardness 40 (JISA) about an elastic layer, and is the surface average of roughness height Rd. Since it is referred to as 5-15 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0067] Moreover, the electrification roller of this invention is the surface average of roughness height Rd about an elastic layer. Since it considers as the epichlorohydrin rubber or polyurethane rubber the thickness of whose it is 5-15 micrometers and is 1-5mm, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0068] Moreover, the electrification roller of this invention is the surface average of roughness height Rd of an elastic layer about the average thickness of a surface layer. Since it considers as 2 double less or equal, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0069] Moreover, the electrification roller of this invention is the surface average of roughness height Rs of a surface layer. Since it is referred to as 3-10 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0070] Moreover, since the electrification roller of this invention uses a surface layer as the non-adhesive property resin coat thick [to the surface crevice of an elastic layer] and applied to it thinly at heights, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

[0071] Moreover, since the electrification roller of this invention constitutes a surface layer from synthetic resin which has solubility to alcohol, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

[0072] Moreover, since the electrification roller of this invention considers a surface layer as the configuration containing at least one of the components of various inorganic bulking agents, various conductive particles, and an elastic layer, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

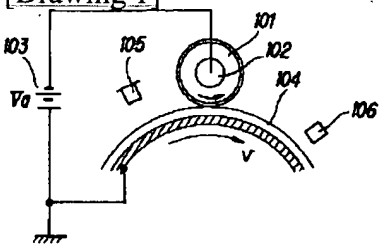
[Translation done.]

* NOTICES *

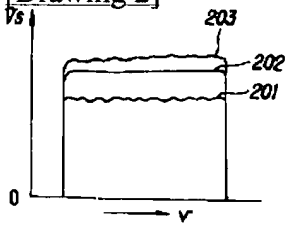
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

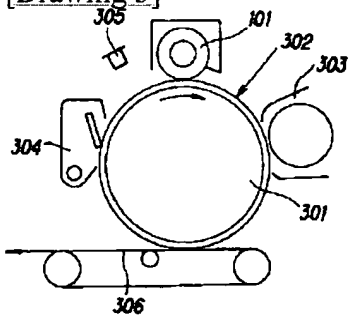
[Drawing 1]



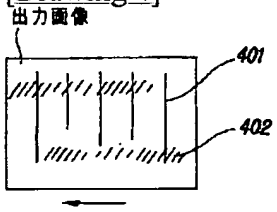
[Drawing 2]



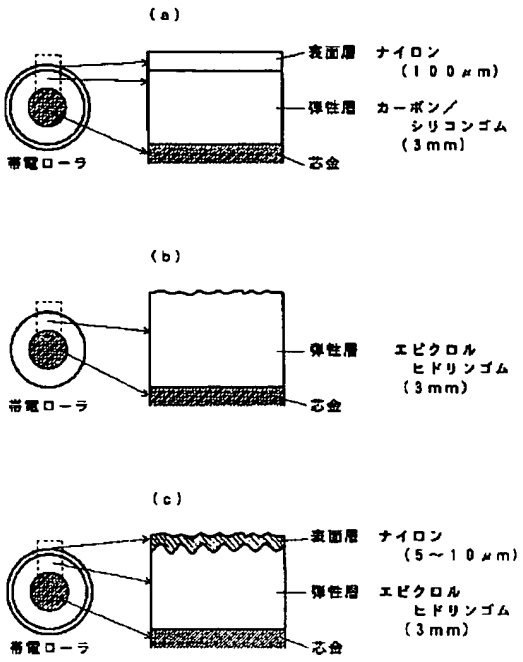
[Drawing 3]



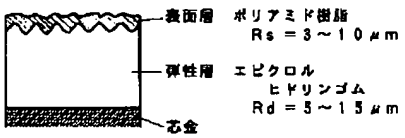
[Drawing 4]



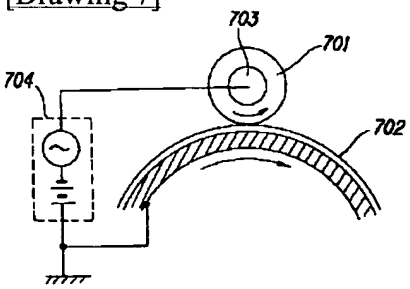
[Drawing 5]



[Drawing 6]



[Drawing 7]



[Translation done.]

* NOTICES *

CORRECTION OR AMENDMENT

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[Procedure revision]
[Filing Date] August 31, Heisei 12 (2000. 8.31)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Whole sentence
[Method of Amendment] Modification
[Proposed Amendment]
[Document Name] Specification
[Title of the Invention] An electrification roller and image formation equipment
[Claim(s)]
[Claim 1] The front face of an elastic layer and said elastic layer is set at least on the electrification roller which has two-layer [of a wrap surface layer], and it is the surface average of roughness height Rd of said elastic layer. The surface average of roughness height Rs of said surface layer Electrification roller characterized by the large thing.
[Claim 2] In the electrification roller which has two-layer [of a wrap surface layer], electric resistance consists of polar synthetic rubber of 107 - 1010 ohm-cm in the front face of an elastic layer and said elastic layer, and said elastic layer at least is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers.
[Claim 3] In the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least, said elastic layer is more than rubber degree-of-hardness 40 (JISA), and it is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers.
[Claim 4] Setting the front face of an elastic layer and said elastic layer at least on the electrification roller which has two-layer [of a wrap surface layer], said elastic layer is the surface average of roughness height Rd. Electrification roller characterized by being 5-15 micrometers and being the epichlorohydrin rubber or polyurethane rubber whose thickness is 1-5mm.
[Claim 5] Setting the front face of an elastic layer and said elastic layer at least on the electrification roller which has two-layer [of a wrap surface layer], the average thickness of said surface layer is the surface average of roughness

height Rd of said elastic layer. Electrification roller characterized by being 2 double less or equal.
[Claim 6] The front face of an elastic layer and said elastic layer is set at least on the electrification roller which has two-layer [of a wrap surface layer], and it is the surface average of roughness height Rs of said surface layer. Electrification roller characterized by being 3-10 micrometers.
[Claim 7] It is the electrification roller characterized by consisting of a non-adhesive property resin coat which was thick to the surface crevice of said elastic layer in the electrification roller which has two-layer [of a wrap surface layer] as for said surface layer, and was thinly applied in the front face of an elastic layer and said elastic layer at heights at least.
[Claim 8] It is the electrification roller characterized by consisting of synthetic resin in which said surface layer has solubility to alcohol in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least.
[Claim 9] It is the electrification roller characterized by said surface layer containing at least one of the components of various inorganic bulking agents, various conductive particles, and said elastic layer in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and said elastic layer at least.
[Claim 10] Image formation equipment characterized by consisting the front face of an elastic layer and said elastic layer of an electrification roller with which said electrification roller was indicated by any one of said the claims 1-9 in the image formation equipment using the electrification roller which has two-layer [of a wrap surface layer] at least.
[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates the front face of an elastic layer and this elastic layer to the image formation equipment using the electrification roller and this electrification roller which have two-layer [of a wrap surface layer] at least more at a detail about the image formation equipment using the electrification roller and this electrification roller which are used for contact roller electrification equipment.
[0002]
[Description of the Prior Art] Conventionally, in the image formation equipment of an electrophotography method, the corona discharge machine was widely used as an electrification means for a photo conductor front face being charged completely uniformly. Although it is effective as a means by which a photo conductor is charged in a certain fixed potential at homogeneity if it is in this corona discharge machine, on the contrary, if it is in the electrification processing by corona discharge, a high voltage power supply is needed, and ozone occurs with discharge. When ozone occurred in large quantities, it not only has a bad influence on an environment, but there was a trouble that an electrification member and a photo conductor deteriorated by ozone.
[0003] To the above-mentioned corona discharge machine, as shown in drawing 7, the electrification roller 701 is contacted to the photo conductor drum 702, and carries out follower rotation, and the electrification roller which an electrical potential difference is impressed [roller] to the rodding 703 of the electrification roller 701 from a power source 704, and electrifies photo conductor drum 702 front face is put in practical use. The electrification roller 701 as this electrification means can attain low-battery-ization of a power source 704, and has the advantage that there are few yields of the ozone resulting from electrification processing. Moreover, there is no electrostatic adsorption of the dust accompanying use of a corona electrode wire, and it also has the advantage of not needing a high voltage power supply.
[0004] However, are easy to come out of electrification nonuniformity, and an electrification roller has the fault of changing electrification potential sharply by environmental change, and the present condition is that it is considerably inferior about the homogeneity of this electrification as compared with the electrification processing with a corona discharge machine.
[0005] For this reason, in order to improve the homogeneity of electrification, by the "contact electrification approach" of JP,63-149668,A, it is indicating that the homogeneity of electrification can improve considerably by making alternating voltage with the starting potential (VTH) at the time of direct-current-voltage impression twice [more than] the electrical potential difference between peaks of electrification superimpose.
[0006]
[Problem(s) to be Solved by the Invention] However, if it is in the "contact electrification approach" of above-mentioned JP,63-149668,A In order to make alternating voltage with the starting potential (VTH) at the time of direct-current-voltage impression twice [more than] the electrical potential difference between peaks of electrification superimpose, Apart from a DC power supply, an AC power is needed, and it invites the cost rise of equipment itself, and power-source cost not only goes up, but further, useless AC current which does not contribute to electrification of a photo conductor will be consumed so much, and a lot of ozone occurs in connection with it. Consequently, an electrification member, Degradation of a photo conductor was invited and there was un-arranging [of having developed

even into a pollution problem further].
[0007] For this reason, in order to enable it for this invention person to perform electrical-potential-difference impression on an electrification roller only using a DC power supply, without using an AC power, the electrification roller using the polar synthetic rubber (epichlorohydrin rubber) of inside resistance in an elastic layer is proposed. As a result of considering the cause by which electrification nonuniformity generates [this invention person] this only in DC electrical-potential-difference impression, the elastic layer originates in it being the dispersion layer of synthetic rubber and carbon, Namely, it is what is depended on the electric heterogeneity of the conductive elastic layer depended badly [distribution of carbon/synthetic rubber]. Electric heterogeneity is abolished and it enables it to cancel the electrification nonuniformity which is generated only in DC electrical-potential-difference impression by discovering a certain thing and transposing the elastic layer by the carbon/synthetic rubber of an electrification roller to the polar synthetic rubber (epichlorohydrin rubber) of inside resistance.
[0008] Moreover, only in DC electrical-potential-difference impression, although the withstand voltage of a roller layer poses a problem, as compared with the case of the conductive elastic layer of the conventional carbon / synthetic-rubber system, withstand voltage nature is remarkably raised by using the epichlorohydrin rubber of inside resistance in an elastic layer. Furthermore, epichlorohydrin rubber has a rubber degree of hardness comparatively as high as 40 (JISA), and since there is also little elastic strain deformation, a mechanical strength is also good [rubber].
[0009] Although the addition of carbon was able to adjust apparent electric resistance in the conductive elastic layer of the conventional carbon / synthetic-rubber dispersed system, it was very difficult to reconcile moderate conductivity (108 omega-cm) and withstand voltage nature. And since the part of carbon differed in electric resistance greatly from the part of synthetic rubber when it sees micro, it worsened the homogeneity of electrification, and withstand voltage nature. However, when rubber itself used the polar synthetic rubber of inside resistance (107 - 108 omega-cm) for the electrification roller elastic layer, without being based on content of conductive particles, such as carbon, all the troubles that come from the electrical characteristics of the above-mentioned electrification roller were solved.
[0010] The above-mentioned electric and mechanical property are excellent. The electrification roller of the polar synthetic rubber of inside resistance in which homogeneity electrification is possible actually only by DC electrical-potential-difference impression however, as roller electrification equipment of a copying machine (image formation equipment) Since an electrification roller and a photo conductor are in a pressure-welding condition during a pause of a copying machine when it is used, The trouble that a horizontal stripe-like abnormality image is generated in the image of the 1st sheet after a prolonged pause, and the trouble that a toner would adhere to a roller front face and the electrification engine performance of an electrification roller would fall if an electrification roller is used for a long period of time occurred.
[0011] Moreover, as a conventional technique relevant to this invention, there are JP,58-194061,A "roller electrification equipment" and JP,2-222985,A "electrophotography equipment."
[0012] The equipment of JP,58-194061,A removes the toner dirt of an electrification roller front face by approaching the electrification roller front face which consists of a conductive elastic body, and preparing a cleaning component, and carrying out the coat of the non-adhesive property coat to the front face of a conductive elastic body.
[0013] Moreover, the equipment of JP,2-222985,A is the relation of ten-point surface average-of-roughness-height RZ1 of a photo conductor, and ten-point surface average-of-roughness-height RZ2 of the member for electrification,
2<=6.0 micrometers of 0.1 micrometer<=RZ 1+RZ
(However, 1<=5.0 micrometers of 0.05 micrometer<=RZ, 2<=5.0 micrometers of 0.05 micrometer<=RZ)
The moderate split-face section used as a photo conductor and the origin of discharge to each of both of the member for electrification is formed, the fall of breakdown voltage is aimed at, the electrification capacity of the member for electrification is raised, and it enables it to perform uniform electrification excellent in the potential property by carrying out.
[0014] This invention is made in view of the above, and it aims at offering the image formation equipment using the electrification roller and this electrification roller which raised endurance by improving an inside resistance polarity synthetic-rubber front face in a photo conductor and a toner, and the good condition of a non-adhesive property.
[0015]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer A large electrification roller is offered.
[0016] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer], electric resistance consists of polar synthetic rubber of 107 - 1010 ohm-cm in

the front face of an elastic layer and an elastic layer at least, and an elastic layer is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers is offered.

[0017] Moreover, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least in order that this invention may attain the above-mentioned purpose, an elastic layer is more than rubber degree-of-hardness 40 (JISA), and it is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers is offered.

[0018] Moreover, in order that this invention may attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and an elastic layer is the surface average of roughness height Rd. The electrification roller which is 5-15 micrometers and is the epichlorohydrin rubber or polyurethane rubber whose thickness is 1-5mm is offered.

[0019] Moreover, in order that this invention may attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and the average thickness of a surface layer is the surface average of roughness height Rd of an elastic layer. The electrification roller which is 2 double less or equal is offered.

[0020] Moreover, in order to attain the above-mentioned purpose, it sets on the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, and this invention is the surface average of roughness height Rs of a surface layer. The electrification roller which is 3-10 micrometers is offered.

[0021] Moreover, in order that this invention may attain the above-mentioned purpose, the electrification roller which consists of a non-adhesive property resin coat which the surface layer was thick to the surface crevice of an elastic layer in the electrification roller which has two-layer [of a wrap surface layer], and was thinly applied in the front face of an elastic layer and an elastic layer at heights at least is offered.

[0022] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, a surface layer offers the electrification roller which consists of synthetic resin which has solubility to alcohol.

[0023] Moreover, in order that this invention may attain the above-mentioned purpose, in the electrification roller which has two-layer [of a wrap surface layer] for the front face of an elastic layer and an elastic layer at least, a surface layer offers the electrification roller containing at least one of the components of various inorganic bulking agents, various conductive particles, and said elastic layer.

[0024] Moreover, this invention offers the image formation equipment with which an electrification roller consists the front face of an elastic layer and an elastic layer of an electrification roller indicated by any one of the claims 1-9 in the image formation equipment using the electrification roller which has two-layer [of a wrap surface layer] at least, in order to attain the above-mentioned purpose.

[0025]

[Function] The electrification roller of this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer A non-adhesive property is improved maintaining an electrification property by enlarging.

[0026] Moreover, in the electrification roller of this invention, electric resistance constitutes an elastic layer from polar synthetic rubber of 107 - 1010 ohm-cm, and it is the surface average of roughness height Rd. A non-adhesive property is improved maintaining an electrification property by being referred to as 5-15 micrometers.

[0027] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd about an elastic layer above rubber degree-of-hardness 40 (JISA). A non-adhesive property is improved maintaining an electrification property by being referred to as 5-15 micrometers.

[0028] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd about an elastic layer. A non-adhesive property is improved maintaining an electrification property by considering as the epichlorohydrin rubber or polyurethane rubber the thickness of whose is 1-5mm by 5-15 micrometers.

[0029] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rd of an elastic layer about the average thickness of a surface layer. A non-adhesive property is improved maintaining an electrification property by considering as 2 double less or equal.

[0030] Moreover, it sets on the electrification roller of this invention, and is the surface average of roughness height Rs of a surface layer. A non-adhesive property is improved maintaining an electrification property by being referred to as 3-10 micrometers.

[0031] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by using a surface layer as the non-adhesive property resin coat thick [to the surface crevice of

an elastic layer] and applied thinly at heights.
[0032] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by constituting a surface layer from synthetic resin which has solubility to alcohol.
[0033] Moreover, a non-adhesive property is improved in the electrification roller of this invention, maintaining an electrification property by considering a surface layer as the configuration containing at least one of the components of various inorganic bulking agents, various conductive particles, and an elastic layer.
[0034] Moreover, the image formation equipment of this invention improves a non-adhesive property, maintaining the electrification property of an electrification roller by using the electrification roller indicated by any one of the claims 1-9.
[0035]
[Example] The power source to which drawing 1 shows the electrification roller experimental device for evaluating the electrification property of an electrification roller, the electrification roller with which 101 is set as the object of evaluation, and 102 impress rodding of the electrification roller 101 to the rodding 102 of the electrification roller 101 in drawing, and 103 impresses the DC electrical potential difference Va, and 104 are electrometers for a photo conductor drum and 105 to measure an electric discharge lamp, and at least for electrification of the front face of the photo conductor drum 104 measure Vs, as for 106.
[0036] In the above configuration, how to evaluate the electrification property of an electrification roller using the above-mentioned roller electrification experimental device is explained. First, the DC electrical potential difference Va is impressed to the electrification roller 101 which contacts the photo conductor drum 104 which rotates with linear velocity v, and carries out follower rotation, at least electrification is charged in Vs in photo conductor drum 104 front face discharged with the electric discharge lamp 105, and at least electrification of the photo conductor drum 104 measures Vs with an electrometer 106. From the electrification property chart which it is as a result of [of this electrometer 106] measurement, as shown in drawing 2, at least the standup of Vs and electrification can evaluate the homogeneity of Vs and Vs.
[0037] Drawing 3 shows the image formation equipment of a roller electrification method, and in drawing, a drum cleaner and 305 show an electric discharge lamp, 306 shows an imprint belt, and the laser beam a photo conductor drum and whose 302 101 is exposure information as for an electrification roller and 301, and 303 use a developer and 304 in order to check the trouble on real use of an electrification roller. As shown in drawing 4, an output image is checked, the non-adhesive property over the photo conductor of an electrification roller is evaluated from ** horizontal stripe image (roller trace on a photo conductor) 401, and, specifically, the cleaning nature on the front face of a roller is evaluated from the dirt 402 of the image after ** running test. As an electrification roller 101 of the image formation equipment of the roller electrification method of this drawing 3, what applied the electrification roller of this invention serves as an example of the image formation equipment of this invention.
[0038] Drawing 5 shows the configuration of the electrification roller by this invention, the electrification roller of the example of a comparison, and the conventional electrification roller, and Table 1 shows each property of the electrification roller shown in drawing 5.
[0039]
[Table 1]

	帯電特性			表面性	
	立上り	帯電性	均一性	非接着性	クリーニング性
従来例	○	△	×	○	○
比較例	○	○	○	×	×
本発明	○	○	○	○	○

[0040] Drawing 5 (a) shows the conventional electrification roller, and has prepared the nylon (polyamide resin) surface layer (100-micrometer thickness, 1012 ohm-cm) on the carbon distribution silicone rubber elastic layer (3mm thickness, electric resistance 104 omega-cm), and as shown in 201 of Table 1 and drawing 2, a problem is in the homogeneity of

electrification. However, AC electrical potential difference is superimposed on DC electrical potential difference, and homogeneity electrification will be acquired if electrical-potential-difference impression is carried out.

[0041] Although the homogeneity of electrification of at least electrification is improved as the electrification roller as an example of a comparison is shown, and it consists of a monolayer of epichlorohydrin rubber (3mm thickness, electric resistance 108 omega-cm) and is shown in 203 of Table 1 and drawing 2, front-face nature of drawing 5 (b) is bad, and is not practical.

[0042] drawing 5 (c) shows the electrification roller of this invention, split-face-izes a resistance (107 - 108 omega-cm)-into more than rubber degree-of-hardness 40 (JISA) polarity synthetic-rubber (epichlorohydrin rubber) elastic layer, and embeds a part for the crevice -- as The thin (1-5-micrometer thickness) exaggerated code layer (surface layer) of non-adhesive property resin (nylon: 1010 ohm-cm) is prepared, and front-face nature was able to be made to improve sharply, maintaining the electrification property of the electrification roller (drawing 5 (b)) as an example of a comparison, as shown in 202 of Table 1 and drawing 2. Hereafter, an example explains to a detail.

[0043] [Example 1] First, epichlorohydrin rubber elastic layer was cast so that a roller outer diameter might be set to about 16 phi at rodding of 8phi. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA). While making this elastic roller into 3mm of elastic thickness by mechanical polishing, it is the ten-point surface average of roughness height Rd. Every three each were ground so that it might be set to 3 micrometers, 5 micrometers, 10 micrometers, 15 micrometers, 20 micrometers, and 30 micrometers.

[0044] Next, on this elastic layer, as a surface layer, with the spray method, the paint film of polyamide resin was applied so that that average thickness might be set to 5 micrometers, 10 micrometers, and 30 micrometers, and the electrification roller of an example 1 was created.

[0045] Then, the ten-point surface average of roughness height Rs of the surface layer (namely, roller front face) of the created electrification roller It measured. The ten-point surface average of roughness height Rs of this surface layer Measurement was performed using the surface type-like measuring instrument (SE-30H, Kosaka Laboratory make) based on JIS surface roughness (BO601).

[0046] It is the surface average of roughness height Rd as mentioned above. The evaluation result of the surface average of roughness height Rs of a total of 18 electrification rollers which prepared and created the surface layer which consists of polyamide resin of 5-30 micrometers of average thickness on epichlorohydrin rubber elastic layer (3mm in thickness), an electrification property, and front-face nature is shown in Table 2.

[0047]

[Table 2]

Rd (μm)	表面層 平均厚さ	Rs (μm)	帯電特性		表面性	
			Vs	均一性	非接着性	クリーニング性
3		6		×	×	×
5		5		△	△	△
10	5 μm	8	800V	○	△	△
15		12		○	△	△
20		17		×	△	△
30		25		×	△	△
3		4		○	△	△
5		4		○	○	○
10	10 μm	6	750V	○	○	○
15		10		○	○	○
20		14		×	○	△
30		16		×	○	△
3		3		○	○	○
5		3		○	○	○
10	30 μm	5	660V	○	○	○
15		9		△	○	○
20		12		×	○	△
30		14		×	○	△

[0048] It is the surface average of roughness height Rs on the front face of a roller (surface layer) so that clearly from the above-mentioned table 2. The surface average of roughness height Rd of an elastic layer It depends also on the thickness and the method of application of a surface layer the outside for which it depends. It is desirable that it can apply so that the surface roughness of an elastic layer may moreover be corrected by as thin the surface layer as possible. Vs falls, so that an electrification property has a thick surface layer, and the homogeneity of electrification is Rd. It worsens, so that it is large. However, Rd 5 Carrying out to below mum is contrary to improving in a photo conductor and a toner, and the good condition of a non-adhesive property, using the sand PURASUTO method etc. for surface polish, and maintaining the electrification property which it becomes [a manufacturing cost] high and is not not only desirable, but is the purpose of this invention. Moreover, front-face nature is so good that a surface layer is thick, and has the relation which disagrees with an electrification property.

[0049] Therefore, the following conclusions can be obtained from the above experimental data. As shown in drawing 6, it is the surface average of roughness height Rd. On the epichlorohydrin rubber elastic layer which is 5-15 micrometers, average thickness is Rd. About the polyamide resin surface layer (Rs:3-10micrometer) of 2 double less or equal, it is Rd of epichlorohydrin rubber elastic layer. By coating so that it may be made small, the electrification roller excellent in an electrification property and front-face nature (endurance) can be obtained.

[0050] Furthermore, the surface average of roughness height Rd By being referred to as 5-15 micrometers, the cost for surface polish is reducible.

[0051] [Example 2] First, a polyurethane rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness,

and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x109. Omega-cm and a rubber degree of hardness were 40 (JISA).

[0052] Low resistance-ization of polyurethane rubber can be attained by carrying out content molding of the alkali-metal salt to polyurethane rubber. And the reduction in resistance is [in / the whole elastic layer / there is also no variation in resistance like / in conductive particle distribution of carbon etc. / in this case, and] possible to homogeneity (refer to ****** No. 189876 [63 to] official report). Especially, a fault halogen oxygen acid salt is the optimal also in an alkali-metal salt. Moreover, when 0.05wt% lithium perchlorate is added to polyurethane rubber, resistance falls a single figure and it is 3x108. It becomes omega-cm.

[0053] Next, the copolyamide (CM8000) 6 weight section was dissolved in the methanol 100 weight section, on the polyurethane rubber elastic layer, it applied by the dipping method and the surface layer was formed. The surface layer average thickness after desiccation is 7 micrometers, and is the surface average of roughness height Rs. It was 6 micrometers.

[0054] the place measured with the roller electrification experimental device which showed the electrification property of this electrification roller to drawing 1 -- Va=-1.5kV -- receiving -- the OPC photo conductor drum 104 (28 micrometers of thickness) -- Vs=600-620V -- it has been mostly charged in homogeneity. As compared with the case where an elastic layer is epichlorohydrin rubber, it is thought that the thing with Vs low about 150v is because electric resistance is high a single figure on these conditions. However, if it is used by Va=-1.6kV, there will be no practical problem.

[0055] Then, as a result of performing a running test using the image formation equipment shown in drawing 3, also after 10 K sheet use, there was also no generating of abnormality images, such as a horizontal stripe, and Vs fall by the dirt of an electrification roller front face was also satisfactory on the image.

[0056] In addition, as synthetic resin which has solubility to alcohol by surface layer configuration resin, polyvinyl butyral resin and poly vinyl alcohol resin were effective in addition to Nylon.

[0057] [Example 3] First, epichlorohydrin rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness, and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA).

[0058] Next, the solvent meltable mold fluororesin solution (solid content: 10.8wt%) was diluted with the toluol, and coating was carried out with the spray method on the above-mentioned elastic layer. The surface layer average thickness after desiccation is 6 micrometers, and is the roller surface average of roughness height Rs. It was 7.5 micrometers.

[0059] When the electrification property of this electrification roller was measured with the roller electrification experimental device of drawing 1, it was Vs=770V and homogeneity was also good. Moreover, as a result of performing a running test using the image formation equipment shown in drawing 3, there was no generating of an abnormality image also after [of 20] K sheets. Especially concerning the front-face nature of an electrification roller, the fluororesin improved the mold-release characteristic over a toner, and cleaning nature improved.

[0060] In addition, as non-adhesive property resin of a surface layer configuration, silicon resin, urethane resin, acrylic resin, polyethylene resin, polyamide resin, etc. were effective in addition to the fluororesin.

[0061] [Example 4] First, epichlorohydrin rubber elastic layer is cast to rodding of 8phi, and they are 3mm of thickness, and the ten-point surface average of roughness height Rd by mechanical polishing. It ground so that it might be set to 10 micrometers. The electric resistance of this elastic layer is 3x108. Omega-cm and a rubber degree of hardness were 40 (JISA).

[0062] Next, the epichlorohydrin rubber solution (solid content: 2.5wt%) 100 weight section, the solvent meltable mold fluororesin solution (solid content: 10.8wt%) 80 weight section, and the silica 0.6 weight section were dissolved in the toluol, and coating was carried out with the spray method on the elastic layer. The surface layer average thickness after desiccation is 8 micrometers, and is the surface average of roughness height Rs. It was 7 micrometers.

[0063] When the electrification property of this electrification roller was measured with the roller electrification experimental device of drawing 1, it was as high as Vs=800V and homogeneity was good. This is based on the effectiveness of having made the surface layer containing epichlorohydrin rubber. On the other hand, the non-adhesive property over OPC (photo conductor drum) has been remarkably improved by addition of a silica, and generating of a horizontal stripe of the front-face nature of an electrification roller was completely lost in the image of the 1st sheet after a prolonged pause.

[0064] In addition, as an inorganic bulking agent, there are a zinc oxide, titanium oxide, tin oxide, etc. in addition to a silica.

[0065] [Example 5] When creating the electrification roller of an example 3, and 3wt% of carbon addition was performed in silicon resin use and the electrification roller was created to it as non-adhesive property resin of a surface layer, as compared with what does not perform carbon addition, the electrification property (about electrification homogeneity) has been improved further.

[0066]

[Effect of the Invention] As explained above, the electrification roller of this invention is the surface average of roughness height Rd of an elastic layer. The surface average of roughness height Rs of a surface layer Since it is large, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0067] Moreover, electric resistance constitutes an elastic layer from polar synthetic rubber of 107 - 1010 ohm-cm, and the electrification roller of this invention is the surface average of roughness height Rd. Since it is referred to as 5-15 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0068] Moreover, the electrification roller of this invention is more than rubber degree-of-hardness 40 (JISA) about an elastic layer, and is the surface average of roughness height Rd. Since it is referred to as 5-15 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0069] Moreover, the electrification roller of this invention is the surface average of roughness height Rd about an elastic layer. Since it considers as the epichlorohydrin rubber or polyurethane rubber the thickness of whose it is 5-15 micrometers and is 1-5mm, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised. Moreover, the surface average of roughness height Rd Since it is 5-15 micrometers, the cost for surface polish is reducible.

[0070] Moreover, the electrification roller of this invention is the surface average of roughness height Rd of an elastic layer about the average thickness of a surface layer. Since it considers as 2 double less or equal, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0071] Moreover, the electrification roller of this invention is the surface average of roughness height Rs of a surface layer. Since it is referred to as 3-10 micrometers, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and endurance can be raised.

[0072] Moreover, since the electrification roller of this invention uses a surface layer as the non-adhesive property resin coat thick [to the surface crevice of an elastic layer] and applied to it thinly at heights, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

[0073] Moreover, since the electrification roller of this invention constitutes a surface layer from synthetic resin which has solubility to alcohol, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

[0074] Moreover, since the electrification roller of this invention considers a surface layer as the configuration containing at least one of the components of various inorganic bulking agents, various conductive particles, and an elastic layer, an inside resistance polarity synthetic-rubber front face is improved by a photo conductor and a toner, and the good condition of a non-adhesive property, and it can raise endurance.

[0075] Moreover, maintaining an electrification property, in order to use the electrification roller indicated by any one of the claims 1-9, the image formation equipment of this invention can improve a non-adhesive property, and can offer the image formation equipment which raised the endurance of an electrification roller.

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the electrification roller experimental device for evaluating the electrification property of an electrification roller.

[Drawing 2] It is an electrification property chart like electrification measured with the electrification roller experimental device of drawing 1.

[Drawing 3] It is the explanatory view showing the configuration of the image formation equipment of a roller electrification method.

[Drawing 4] It is the explanatory view showing how to check the electrification nonuniformity by roller electrification by the output image.

[Drawing 5] It is the explanatory view showing the configuration of the electrification roller by this invention, the electrification roller of the example of a comparison, and the conventional electrification roller.
[Drawing 6] It is the explanatory view showing the electrification roller of this invention obtained from the result of an example 1.
[Drawing 7] It is the explanatory view showing the operation of the electrification roller in the former.
[Description of Notations]
101 Electrification Roller
102 Rodding
104 Photo Conductor Drum
302 Laser Beam

[Translation done.]

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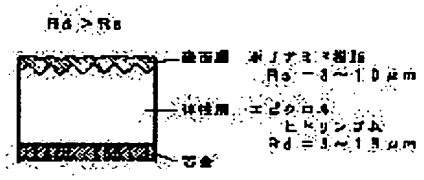
(54) ELECTROSTATICALLY CHARGING ROLLER

(57)Abstract:
PURPOSE: To improve durability by improving the surface of middle-resistance polar synthetic rubber to a state of good non-adhesiveness of a photosensitive body and toners.
CONSTITUTION: The center line average height Rd of the elastic layer of the electrostatic charging roller having at least two layers; the elastic layer and a surface layer covering the surface of the elastic layer is set larger than the center line average height Rs of the surface layer. For example, the surface of the epichlorhydrine rubber elastic layer having 5 to 15μm center line average height Rd is coated with a polyamide resin surface layer (Rs: 3 to 10μm) having an average film thickness of ≤2 times Rd in such a manner that the Rd of the epichlorhydrine rubber elastic layer is made small.



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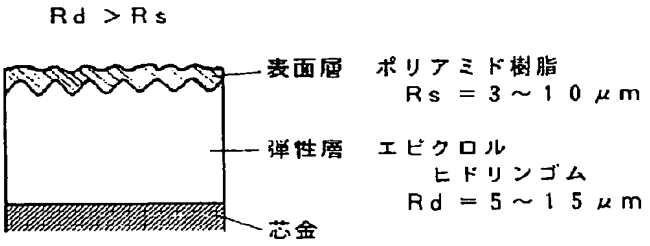
(54)【発明の名称】帯電ローラ

(57)【要約】

【目的】　中抵抗極性合成ゴム表面を感光体およびトナーと非接着性のよい状態に改良することにより，耐久性を向上させる。

【構成】　少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，弾性層の表面平均粗さＲｄを表面層の表面平均粗さＲｓよりも大きくする。例えば，表面平均粗さＲｄが５～１５μｍのエピクロルヒドリンゴム弾性層上に，平均膜厚がＲｄの２倍以下のポリアミド樹脂表面層（Ｒｓ：３～１０μｍ）を，エピクロルヒドリンゴム弾性層のＲｄを小さくするようにコーティングする。



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【特許請求の範囲】

【請求項１】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記弾性層の表面平均粗さＲｄが前記表面層の表面平均粗さＲｓよりも大きいことを特徴とする帯電ローラ。

【請求項２】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記弾性層は，電気抵抗が10^{7}～10^{10}Ω・ｃｍの極性合成ゴムから構成され，かつ，その表面平均粗さＲｄが５～１５μｍであることを特徴とする帯電ローラ。

【請求項３】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記弾性層は，ゴム硬度４０（ＪＩＳＡ）以上で，かつ，その表面平均粗さＲｄが５～１５μｍであることを特徴とする帯電ローラ。

【請求項４】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記弾性層は，表面平均粗さＲｄが５～１５μｍで，かつ，厚さが１～５ｍｍのエピクロルヒドリンゴムあるいはウレタンゴムであることを特徴とする帯電ローラ。

【請求項５】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記表面層の平均膜厚は，前記弾性層の表面平均粗さＲｄの２倍以下であることを特徴とする帯電ローラ。

【請求項６】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記表面層の表面平均粗さＲｓが３～１０μｍであることを特徴とする帯電ローラ。

【請求項７】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記表面層は，前記弾性層の表面凹部に厚く，凸部に薄く塗布された非接着性樹脂被膜からなることを特徴とする帯電ローラ。

【請求項８】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記表面層は，アルコールに対して溶解性を持つ合成樹脂から構成されていることを特徴とする帯電ローラ。

【請求項９】　少なくとも弾性層と，前記弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，前記表面層は，各種無機充填剤，各種導電性粒子および前記弾性層の構成材料のうち，少なくとも一つを含有することを特徴とする帯電ローラ。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は，接触ローラ帯電装置に用いる帯電ローラに関し，より詳細には，少なくとも弾性層と，該弾性層の表面を被う表面層の２層を有する帯電ローラに関する。

【０００２】

【従来の技術】従来，電子写真方式の画像形成装置において，感光体表面を一様に全面帯電するための帯電手段としては，コロナ放電器が広く利用されていた。このコロナ放電器にあっては，感光体をある一定の電位に均一に帯電する手段としては有効であるが，反対に，コロナ放電による帯電処理にあっては高圧電源を必要とし，放電に伴いオゾンが発生する。オゾンが大量に発生すると環境に悪影響を及ぼすばかりでなく，オゾンによって帯電部材，感光体が劣化するという問題点もあった。

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【０００３】上記のコロナ放電器に対して，図７に示すように帯電ローラ７０１を感光体ドラム７０２に接触させて従動回転させ，帯電ローラ７０１の芯金７０３に電源７０４から電圧を印加して感光体ドラム７０２表面を帯電させる帯電ローラが実用化されている。この帯電手段としての帯電ローラ７０１は，電源７０４の低電圧化を図ることができ，帯電処理に起因するオゾンの発生量が少ないという利点を有している。また，コロナ電極ワイヤの使用に伴う塵埃の静電吸着がなく，高圧電源を必要としないなどの利点も有している。

【０００４】ところが，帯電ローラは，帯電ムラが出やすく，且つ，帯電電位が環境の変化によって大きく変動するという欠点があり，この帯電の均一性に関しては，コロナ放電器による帯電処理と比較して，かなり劣るのが現状である。

【０００５】このため，帯電の均一性を改善するために特開昭６３－１４９６６８号公報の「接触帯電方法」では，直流電圧印加時の帯電開始電圧（V_{th}）の２倍以上のピーク間電圧を持つ交流電圧を重畳させることにより，帯電の均一性がかなり改善できることを開示している。

【０００６】

【発明が解決しようとする課題】しかしながら，上記特開昭６３－１４９６６８号公報の「接触帯電方法」にあっては，直流電圧印加時の帯電開始電圧（V_{th}）の２倍以上のピーク間電圧を持つ交流電圧を重畳させるため，ＤＣ電源とは別にＡＣ電源が必要となり，装置自体のコストアップを招来し，更に，感光体の帯電位には寄与しない無駄なＡＣ電流を多量に消費することとなり，それに伴い電源コストが上昇するばかりでなく，多量のオゾンが発生し，その結果，帯電部材，感光体の劣化を招来し，更には公害問題にまで発展するという不都合があった。

【０００７】このため，本発明者によって，ＡＣ電源を使用せずにＤＣ電源のみを用いて帯電ローラに電圧印加を行えるようにするために，弾性層に中抵抗の極性合成ゴム（エピクロルヒドリンゴム）を用いる帯電ローラが提案されている。これは，本発明者がＤＣ電圧印加のみの場合に帯電ムラが発生する原因を検討した結果，弾性層が合成ゴムとカーボンとの分散層であることに起因していること，すなわち，カーボン／合成ゴムの分散不良による導電性弾性層の電気的不均一性によるものである

ことを発見し，帯電ローラのカーボン／合成ゴムによる弾性層を中抵抗の極性合成ゴム（エピクロルヒドリンゴム）に置き換えることにより，電気的不均一性をなくして，ＤＣ電圧印加のみの場合に発生する帯電ムラを解消できるようにしたものである。

【０００８】また，ＤＣ電圧印加のみの場合には，ローラ層の耐電圧が問題となるが，弾性層に中抵抗のエピクロルヒドリンゴムを使用することにより，従来のカーボン／合成ゴム系の導電性弾性層の場合と比較して，耐電圧性を著しく向上させたものである。さらに，エピクロルヒドリンゴムは，ゴム硬度が４０（ＪＩＳＡ）と比較的高く，弾性歪変形も少ないため，機械的強度も良好である。

【０００９】従来のカーボン／合成ゴム分散系の導電性弾性層では，カーボンの添加量によって見掛けの電気抵抗を調整することができたが，適度な導電性（10^{5} Ω・ｃｍ）と耐電圧性を両立させることが極めて困難であった。しかも，ミクロにみるとカーボンの部分と合成ゴムの部分とで電気抵抗が大きく異なるため，それが帯電の均一性および耐電圧性を悪くしていた。ところが，カーボン等の導電性粒子の含有によらずに，ゴム自体が中抵抗（10^{7} ～10^{8} Ω・ｃｍ）の極性合成ゴムを帯電ローラ弾性層に使用すると，上記の帯電ローラの電気的特性からくる問題点はすべて解決した。

【００１０】しかしながら，上記の電気的・機械的特性が優れ，ＤＣ電圧印加のみで均一帯電が可能な中抵抗の極性合成ゴムの帯電ローラを，実際に複写機のローラ帯電装置として使用したところ，複写機の休止中は，帯電ローラと感光体は圧接状態にあるため，長期間休止後の１枚目の画像に横スジ状の異常画像が発生するという問題点や，帯電ローラを長期間使用すると，ローラ表面にトナーが付着し，帯電ローラの帯電性能が低下するという問題点が発生した。

【００１１】また，本発明に関連する従来技術としては，特開昭５８－１９４０６１号公報「ローラー帯電装置」や，特開平２－２２２９８５号公報「電子写真装置」がある。

【００１２】特開昭５８－１９４０６１号公報の装置は，導電性弾性体からなる帯電ローラ表面に近接してクリーニング素子を設け，また，導電性弾性体の表面に非接着性被膜を被膜することにより，帯電ローラ表面のトナー汚れを除去するようにしたものである。

【００１３】また，特開平２－２２２９８５号公報の装置は，感光体の十点表面平均粗さR_{z1}と，帯電用部材の十点表面平均粗さR_{z2}の関係を，

$0.1\,\mu m \leqq R_{z1} + R_{z2} \leqq 6.0\,\mu m$

（ただし，$0.05\,\mu m \leqq R_{z1} \leqq 5.0\,\mu m$，$0.05\,\mu m \leqq R_{z2} \leqq 5.0\,\mu m$）

とすることにより，感光体と帯電用部材の両者それぞれに放電の起点となる適度な粗面部を形成し，放電開始電圧の低下を図って帯電用部材の帯電能力を向上させ，電位特性に優れた均一な帯電を行えるようにしたものである。

【００１４】本発明は上記に鑑みてなされたものであって，中抵抗極性合成ゴム表面を，感光体およびトナーと非接着性のよい状態に改良することにより，耐久性を向上させた帯電ローラを提供することを目的とする。

【００１５】

【課題を解決するための手段】本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，弾性層の表面平均粗さＲｄが表面層の表面平均粗さＲｓよりも大きい帯電ローラを提供するものである。

【００１６】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，弾性層は，電気抵抗が10^{7} ～10^{10}Ω・ｃｍの極性合成ゴムから構成され，かつ，その表面平均粗さＲｄが５～１５μｍである帯電ローラを提供するものである。

【００１７】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，弾性層は，ゴム硬度４０（ＪＩＳＡ）以上で，かつ，その表面平均粗さＲｄが５～１５μｍである帯電ローラを提供するものである。

【００１８】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，弾性層は，表面平均粗さＲｄが５～１５μｍで，かつ，厚さが１～５ｍｍのエピクロルヒドリンゴムあるいはウレタンゴムである帯電ローラを提供するものである。

【００１９】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，表面層の平均膜厚は，弾性層の表面平均粗さＲｄの２倍以下である帯電ローラを提供するものである。

【００２０】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，表面層の表面平均粗さＲｓが３～１０μｍである帯電ローラ。

【００２１】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，表面層は，弾性層の表面凹部に厚く，凸部に薄く塗布された非接着性樹脂被膜からなる帯電ローラを提供するものである。

【００２２】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を被う表面層の２層を有する帯電ローラにおいて，表面層は，アルコールに対して溶解性を持つ合成樹脂から構成されている帯電ローラを提供するものである。

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【００２３】また，本発明は上記の目的を達成するために，少なくとも弾性層と，弾性層の表面を覆う表面層の２層を有する帯電ローラにおいて，表面層は，各種無機充填剤，各種導電性粒子および前記弾性層の構成材料のうち，少なくとも一つを含有する帯電ローラを提供するものである。

【００２４】

【作用】本発明の帯電ローラは，弾性層の表面平均粗さＲｄを表面層の表面平均粗さＲｓよりも大きくすることにより，帯電特性を維持したまま，非接着性を改善する。

【００２５】また，本発明の帯電ローラにおいて，弾性層を，電気抵抗が10^{7}～10^{10}Ω・ｃｍの極性合成ゴムで構成して，その表面平均粗さＲｄが５～１５μｍとすることにより，帯電特性を維持したまま，非接着性を改善する。

【００２６】また，本発明の帯電ローラにおいて，弾性層を，ゴム硬度４０（ＪＩＳＡ）以上で，その表面平均粗さＲｄが５～１５μｍとすることにより，帯電特性を維持したまま，非接着性を改善する。

【００２７】また，本発明の帯電ローラにおいて，弾性層を，表面平均粗さＲｄが５～１５μｍで，その厚さが１～５ｍｍのエピクロルヒドリンゴムあるいはウレタンゴムとすることにより，帯電特性を維持したまま，非接着性を改善する。

【００２８】また，本発明の帯電ローラにおいて，表面層の平均膜厚を，弾性層の表面平均粗さＲｄの２倍以下とすることにより，帯電特性を維持したまま，非接着性を改善する。

【００２９】また，本発明の帯電ローラにおいて，表面層の表面平均粗さＲｓを３～１０μｍとすることにより，帯電特性を維持したまま，非接着性を改善する。

【００３０】また，本発明の帯電ローラにおいて，表面層を，弾性層の表面凹部に厚く，凸部に薄く塗布された非接着性樹脂被膜とすることにより，帯電特性を維持したまま，非接着性を改善する。

【００３１】また，本発明の帯電ローラにおいて，表面層を，アルコールに対して溶解性を持つ合成樹脂から構成することにより，帯電特性を維持したまま，非接着性を改善する。

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【００３２】また，本発明の帯電ローラにおいて，表面層を，各種無機充填剤，各種導電性粒子および弾性層の構成材料のうち，少なくとも一つを含有する構成とすることにより，帯電特性を維持したまま，非接着性を改善する。

【００３３】

【実施例】図１は，帯電ローラの帯電特性を評価するための帯電ローラ実験装置を示し，図において，１０１は評価の対象となる帯電ローラ，１０２は帯電ローラ１０１の芯金，１０３は帯電ローラ１０１の芯金１０２にＤＣ電圧Ｖａを印加する電源，１０４は感光体ドラム，１０５は除電ランプ，１０６は感光体ドラム１０４の表面の帯電位Ｖｓを測定するための電位計である。

【００３４】以上の構成において，上記ローラ帯電実験装置を用いて帯電ローラの帯電特性を評価する方法について説明する。先ず，線速ｖで回転する感光体ドラム１０４に接触して従動回転する帯電ローラ１０１に，ＤＣ電圧Ｖａを印加して，除電ランプ１０５で除電された感光体ドラム１０４表面を帯電位Ｖｓに帯電し，電位計１０６で感光体ドラム１０４の帯電位Ｖｓを測定する。この電位計１０６の測定結果である帯電特性チャートから，図２に示すように，Ｖｓの立ち上がり，帯電位Ｖｓおよびバラツキの均一性が評価できる。

【００３５】図３は，ローラ帯電方式の画像形成装置を示し，図において，１０１は帯電ローラ，３０１は感光体ドラム，３０２は露光情報であるレーザ光，３０３は現像装置，３０４はドラムクリーナ，３０５は除電ランプ，３０６は転写ベルトを示し，帯電ローラの実使用上の問題点をチェックするために使用するものである。具体的には，図４に示すように，出力画像をチェックし，①横スジ画像（感光体上のローラ痕跡）４０１から帯電ローラの感光体に対する非接着性を評価し，②ランニングテスト後の画像の汚れ４０２からローラ表面のクリーニング性を評価する。

【００３６】図５は，本発明による帯電ローラ，比較例の帯電ローラ，および従来の帯電ローラの構成を示し，表１は図５に示した帯電ローラのそれぞれの特性を示す。

【００３７】

【表１】

	帯電特性			表面性	
	立上り	帯電性	均一性	非接着性	クリーニング性
従来例	○	△	×	○	○
比較例	○	○	○	×	×
本発明	○	○	○	○	○

【００３８】図５（ａ）は従来の帯電ローラを示し，カーボン分散シリコーンゴム弾性層（３ｍｍ厚，電気抵抗

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10^4 Ω・ｃｍ）上にナイロン（ポリアミド樹脂）表面層（１００μｍ厚，10^7 Ω・ｃｍ）を設けてあり，表１および図２の２０１に示すように，帯電の均一性に問題がある。ただし，ＤＣ電圧にＡＣ電圧を重畳して電圧印加すれば均一帯電が得られる。

【００３９】図５（ｂ）は，比較例としての帯電ローラを示し，エピクロルヒドリンゴム（３ｍｍ厚，電気抵抗10^4 Ω・ｃｍ）の単層からなり，表１および図２の２０３に示すように，帯電位および帯電の均一性が改善されているが，表面性が悪く，実用的ではない。

【００４０】図５（ｃ）は，本発明の帯電ローラを示し，ゴム硬度４０（ＪＩＳＡ）以上の中抵抗（10^7 ～10^9 Ω・ｃｍ）極性合成ゴム（エピクロルヒドリンゴム）弾性層を粗面化し，その凹部分を埋め込むように非接着性樹脂（ナイロン：10^{11} Ω・ｃｍ）のうすい（１～５μｍ厚）オーバーコード層（表面層）を設けたものであり，表１および図２の２０２に示すように，比較例としての帯電ローラ（図５（ｂ））の帯電特性を維持したまま，表面性を大幅に改善させることができた。以下，実施例で詳細に説明する。

【００４１】〔実施例１〕先ず，８φの芯金にローラ外径が約１６φとなるようにエピクロルヒドリンゴム弾性

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層を成型した。この弾性層の電気抵抗は，３×10^4 Ω・ｃｍ，ゴム硬度は４０（ＪＩＳＡ）であった。この弾性ローラを機械研磨によって弾性層厚３ｍｍにすると共に，十点表面平均粗さＲｄが，３μｍ，５μｍ，１０μｍ，１５μｍ，２０μｍ，３０μｍとなるように，各３本ずつ研磨した。

【００４２】次に，この弾性層上に表面層としてポリアミド樹脂の塗膜をスプレー法により，その平均厚みが５μｍ，１０μｍ，３０μｍとなるように塗布して実施例１の帯電ローラを作成した。

【００４３】続いて，作成した帯電ローラの表面層（すなわち，ローラ表面）の十点表面平均粗さＲｓを測定した。この表面層の十点表面平均粗さＲｓの測定は，ＪＩＳ表面粗さ（ＢＯ６０１）に基づき，表面形状測定器（ＳＥ－３０Ｈ，小坂研究所製）を用いて行った。

【００４４】上記のように表面平均粗さＲｄのエピクロルヒドリンゴム弾性層（厚さ３ｍｍ）上に，平均膜厚５～３０μｍのポリアミド樹脂から成る表面層を設けて作成した総計１８本の帯電ローラの表面平均粗さＲｓ，帯電特性，表面性の評価結果を表２に示す。

【００４５】

【表２】

Ｒｄ（μｍ）	表面層平均厚さ	Ｒｓ（μｍ）	帯電特性		表面性	
			Ｖｓ	均一性	非接着性	ｸﾘｰﾆﾝｸﾞ性
3	5μｍ	6	800Ｖ	×	×	×
5		5		△	△	△
10		8		○	△	△
15		12		○	△	△
20		17		×	△	△
30		25		×	△	△
3	10μｍ	4	750Ｖ	○	△	△
5		4		○	○	○
10		6		○	○	○
15		10		○	○	○
20		14		×	○	△
30		16		×	○	△
3	30μｍ	3	660Ｖ	○	○	○
5		3		○	○	○
10		5		○	○	○
15		9		△	○	○
20		12		×	○	△
30		14		×	○	△

【００４６】上記の表２から明らかなように，ローラ表面（表面層）の表面平均粗さＲｓは，弾性層の表面平均粗さＲｄに依存する外，表面層の厚さおよび塗布方法にも依る。なるべく，うすい表面層でしかも弾性層の表面粗さを修正するように塗布できることが望ましい。帯電特性は，表面層が厚い程，Ｖｓは低下し，帯電の均一性はＲｄが大きい程，悪くなる。ただし，Ｒｄを5 μｍ以下にすることは，表面研磨にサンドブラスト法等を用いる必要があり，製造コストが高くなり好ましくないばかりでなく，本発明の目的である，帯電特性を維持したまま感光体およびトナーと非接着性のよい状態に改良することに反するものである。また，表面性は，表面層が厚い程よく，帯電特性と相反する関係にある。

【００４７】従って，以上の実験データより，以下の結

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論を得ることができる。図６に示すように，表面平均粗さRd が５～１５μmのエピクロルヒドリンゴム弾性層上に，平均膜厚がRd の２倍以下のポリアミド樹脂表面層（Rs ：３～１０μm）を，エピクロルヒドリンゴム弾性層のRd を小さくするようにコーティングすることにより，帯電特性，表面性（耐久性）とも優れた帯電ローラを得ることができる。

【００４８】さらに，表面平均粗さRd が５～１５μmとすることにより，表面研磨のためのコストが削減できる。

【００４９】〔実施例２〕先ず，８φの芯金にウレタンゴム弾性層を成型し，機械研磨によって層厚３mm，十点表面平均粗さRd が１０μmとなるように研磨した。この弾性層の電気抵抗は，３×１０⁹ Ω・cm；ゴム硬度は４０（ＪＩＳＡ）であった。

【００５０】ウレタンゴムの低抵抗化は，ウレタンゴムにアルカリ金属塩を含有成型することで達成できる。しかも，この場合，カーボン等の導電性粒子分散の場合のように抵抗のバラツキもなく，弾性層全体において均一に低抵抗化が可能である（特開省６３－１８９８７６号公報参照）。特に，アルカリ金属塩の中でも過ハロゲン酸素酸塩が最適である。また，ウレタンゴムに対して，０．０５wt％の過塩素酸リチウムを添加すると，抵抗が１桁低下し，３×１０⁸ Ω・cmとなる。

【００５１】次に，共重合ナイロン（CM８０００）６重量部をメタノール１００重量部に溶解し，ウレタンゴム弾性層上にディッピング法で塗布し，表面層を形成した。乾燥後の表面層平均膜厚は７μmで，表面平均粗さRs は６μmであった。

【００５２】この帯電ローラの帯電特性を図１に示したローラ帯電実験装置で測定したところ，Va＝－１．５KVに対して，OPC感光体ドラム１０４（膜厚２８μm）をVs＝６００～６２０Vほぼ均一に帯電できた。弾性層がエピクロルヒドリンゴムの場合と比較して，同条件でVsが約１５０V低いのは，電気抵抗が１桁高いためであると考えられる。ただし，Va＝－１．６KVで使用すれば実用上の問題はない。

【００５３】続いて，図３に示した画像形成装置を用いて，ランニングテストを行った結果，１０K枚使用後でも，横スジ等の異常画像の発生もなく，帯電ローラ表面の汚れによるVs低下も画像上においては問題なかった。

【００５４】なお，表面層構成樹脂で，アルコールに対して溶解性をもつ合成樹脂としては，ナイロン樹脂以外に，ポリビニールブチラール樹脂，ポリビニールアルコール樹脂が有効であった。

【００５５】〔実施例３〕先ず，８φの芯金にエピクロルヒドリンゴム弾性層を成型し，機械研磨によって層厚３mm，十点表面平均粗さRd が１０μmとなるように研磨した。この弾性層の電気抵抗は，３×１０⁹ Ω・cm，ゴム硬度は４０（ＪＩＳＡ）であった。

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【００５６】次に，溶剤可溶型フッ素樹脂溶液（固形分：１０．８wt％）をトルオールで稀釈し，上記弾性層上にスプレー法で塗工した。乾燥後の表面層平均膜厚は６μmで，ローラ表面平均粗さRs は７．５μmであった。

【００５７】この帯電ローラの帯電特性を，図１のローラ帯電実験装置で測定したところ，Vs＝７７０Vであり，均一性も良好であった。また，図３に示した画像形成装置を用いて，ランニングテストを行った結果，２０K枚後でも異常画像の発生はなかった。帯電ローラの表面性に関しては，特にフッ素樹脂がトナーに対する離型性を良くして，クリーニング性が向上した。

【００５８】なお，表面層構成の非接着性樹脂としては，フッ素樹脂以外に，シリコン樹脂，ウレタン樹脂，アクリル樹脂，ポリエチレン樹脂，ポリアミド樹脂等が有効であった。

【００５９】〔実施例４〕先ず，８φの芯金にエピクロルヒドリンゴム弾性層を成型し，機械研磨によって層厚３mm，十点表面平均粗さRd が１０μmとなるように研磨した。この弾性層の電気抵抗は，３×１０⁹ Ω・cm，ゴム硬度は４０（ＪＩＳA）であった。

【００６０】次に，エピクロルヒドリンゴム溶液（固形分：２．５wt％）１００重量部と溶剤可溶型フッ素樹脂溶液（固形分：１０．８wt％）８０重量部とシリカ０．６重量部とをトルオールに溶解し，弾性層上にスプレー法で塗工した。乾燥後の表面層平均膜厚は８μmで，表面平均粗さRs は７μmであった。

【００６１】この帯電ローラの帯電特性を，図１のローラ帯電実験装置で測定したところ，Vs＝８００Vと高く，均一性は良好であった。これは，表面層にエピクロルヒドリンゴムを含有させた効果によるものである。一方，帯電ローラの表面性は，シリカの添加により，OPC（感光体ドラム）に対する非接着性が著しく改善され，長期間休止後の１枚目の画像において，横スジの発生が完全になくなっていた。

【００６２】なお，無機充填剤としては，シリカ以外に酸化亜鉛，酸化チタン，酸化錫等がある。

【００６３】〔実施例５〕実施例３の帯電ローラを作成する際に，表面層の非接着性樹脂として，シリコーン樹脂使用の場合に，３wt％のカーボン添加を行って帯電ローラを作成したところ，カーボン添加を行わないものと比較して，さらに帯電特性（帯電位，均一性）が改善された。

【００６４】

【発明の効果】以上説明したように　本発明の帯電ローラは，弾性層の表面平均粗さRd が表面層の表面平均粗さRs よりも大きいため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【００６５】また，本発明の帯電ローラは，弾性層を，電気抵抗が10^{7}～10^{10}Ω・ｃｍの極性合成ゴムで構成して，その表面平均粗さＲｄを５～１５μｍとするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。また，表面平均粗さＲｄが５～１５μｍであるため，表面研磨のためのコストが削減できる。

【００６６】また，本発明の帯電ローラは，弾性層を，ゴム硬度４０（ＪＩＳＡ）以上で，その表面平均粗さＲｄを５～１５μｍとするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。また，表面平均粗さＲｄが５～１５μｍであるため，表面研磨のためのコストが削減できる。

【００６７】また，本発明の帯電ローラは，弾性層を，表面平均粗さＲｄが５～１５μｍで，その厚さが１～５ｍｍのエピクロルヒドリンゴムあるいはウレタンゴムとするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。また，表面平均粗さＲｄが５～１５μｍであるため，表面研磨のためのコストが削減できる。

【００６８】また，本発明の帯電ローラは，表面層の平均膜厚を，弾性層の表面平均粗さＲｄの２倍以下とするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【００６９】また，本発明の帯電ローラは，表面層の表面平均粗さＲｓを３～１０μｍとするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【００７０】また，本発明の帯電ローラは，表面層を，弾性層の表面凹部に厚く，凸部に薄く塗布された非接着性樹脂被膜とするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【００７１】また，本発明の帯電ローラは，表面層を，アルコールに対して溶解性を持つ合成樹脂から構成するため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【００７２】また，本発明の帯電ローラは，表面層を，各種無機充填剤，各種導電性粒子および弾性層の構成材料のうち，少なくとも一つを含有する構成とするため，中抵抗極性合成ゴム表面が，感光体およびトナーと非接着性のよい状態に改良されて，耐久性を向上させることができる。

【図面の簡単な説明】

【図１】帯電ローラの帯電特性を評価するための帯電ローラ実験装置の構成図である。

【図２】図１の帯電ローラ実験装置で測定した帯電位の帯電特性チャートである。

【図３】ローラ帯電方式の画像形成装置の構成を示す説明図である。

【図４】ローラ帯電による帯電ムラを出力画像でチェックする方法を示す説明図である。

【図５】本発明による帯電ローラ，比較例の帯電ローラ，および従来の帯電ローラの構成を示す説明図である。

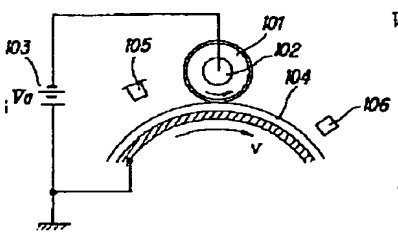
【図６】実施例１の結果より得られた本発明の帯電ローラを示す説明図である。

【図７】従来における帯電ローラの使用方法を示す説明図である。

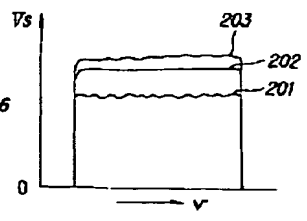
【符号の説明】

１０１　帯電ローラ
１０２　芯金
１０４　感光体ドラム
３０２　感光体ドラム

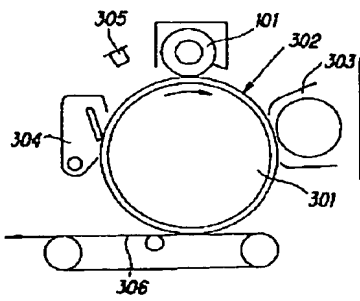
【図１】



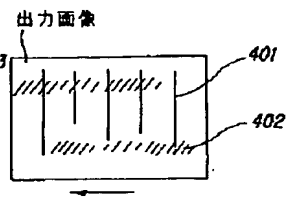
【図２】



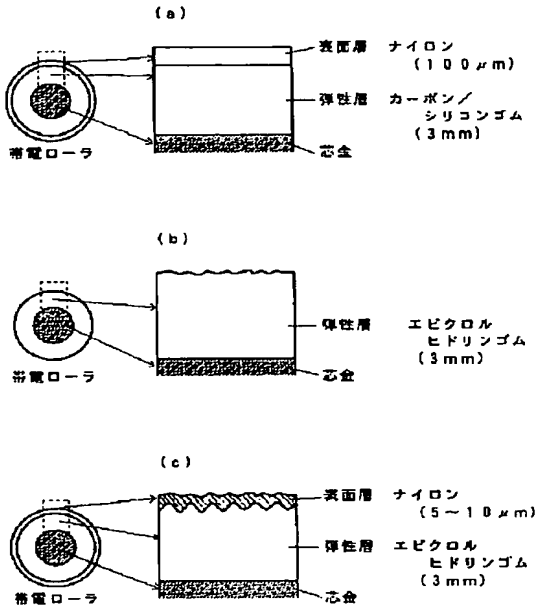
【図３】



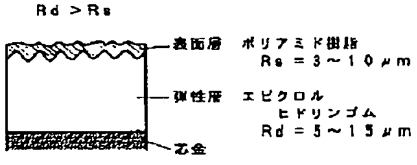
【図４】



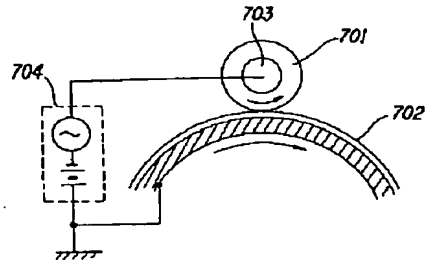
【図５】


(a)
表面層　ナイロン
(１００μm)
弾性層　カーボン／
シリコンゴム
(３mm)
芯金
帯電ローラ
(b)
弾性層　エピクロル
ヒドリンゴム
(３mm)
芯金
帯電ローラ
(c)
表面層　ナイロン
(５～１０μm)
弾性層　エピクロル
ヒドリンゴム
(３mm)
芯金
帯電ローラ

【図６】


Rd ＞Rs
表面層　ポリアミド樹脂
Rs ＝３～１０μm
弾性層　エピクロル
ヒドリンゴム
Rd ＝５～１５μm
芯金

【図７】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